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Construction Machine

The invention relates to a construction machine for working pieces of ground, having a milling roller on whose surface a plurality of chisel holders is arranged, wherein a chisel, in particular a round shaft chisel, is exchangeably received in a chisel receiver of the chisel holder.

Such a construction machine designed as a road-milling machine is known from DE 39 03 482 A1. Road coverings can be cut off by means of road-milling machines. The chisels continuously wear out in the course of the operation of the machine. After the chisels have reached a certain wear state, they must be replaced. In connection with this it is necessary, that a worker approaches the milling roller and there drives the chisels out of the chisel holders. For driving the chisels out, the worker makes use of a special ejection mandrel and a hammer. This can lead to injuries. Manipulation in the narrow milling roller area is extremely difficult and requires great care in order to reduce the risk of danger. After a chisel has been removed from its chisel holder, it is necessary to insert fresh unworn chisels into the chisel holders. Replacement of the chisels constitutes a very arduous and time-consuming job.

Manually operable exchangeable tools are known from DE 32 23 761 C2 and USP 3,342,531. They have a shoulder, which positively engages a circumferential groove in the chisel. The chisels can then be levered out of the associated chisel holder. Although the exchange process is made easier with this, working on the milling roller is nevertheless dangerous and arduous.

It is the object of the invention to create a road-

milling machine of the type mentioned at the outset, wherein the exchange of the chisels is simplified.

This object is attained in that a tool changing device is assigned to the road-milling machine, and that the tool changing device removes and/or mounts the chisel(s) from or in the chisel holder.

Thus, in accordance with the invention a changing tool is proposed, which automatically removes the worn chisel and/or mounts an unworn chisel in the chisel holder receptacle of the chisel holders. In this way it is possible to clearly reduce manual labor necessary for changing the chisels. Because the changing process is at least partially automated, it can be more rapidly performed, so that fewer machine outages are created. Moreover, by means of the device in accordance with the invention the endangerment of the health and the stress on the body of the machine operator are reduced.

The tool changing device preferably is a mechanical tool device. It is arranged inside or outside of the milling roller. Different concepts can be realized, depending on the intended use, in the course of the technical layout of the tool changing device.

a) The tool changer will be positioned in relation to the chisel.

b) The chisel will be positioned in relation to the tool changer.

c) The tool changer and the chisel are positioned in respect to each other.

In connection with the concepts sketched under a) or c), it can be provided in particular that the tool changing device has at least one tool changer, which can be assigned to the individual chisel holders or groups of chisel holders by means of an actuating unit. It is also conceivable that a single tool changer is mutually assigned to all chisels or chisel holders. It then removes or installs the chisels simultaneously. In an alternative embodiment of the invention it can also be provided that a tool changer of the tool changing device is respectively assigned to each chisel holder, and that the tool changers are fixedly connected with the chisel holder. The tool changers can be connected with each other by means of a common control device. A machine operator can, for example, purposefully change individual chisels, groups of chisels, or all chisels together by means of this control device.

A conceivable invention variation can be distinguished in that the tool changing device imparts at least one dynamic pulse opposite the removal direction of the chisel(s) to the milling roller, a portion of the milling roller, the chisel holder or a group of chisel holders. In accordance with this, a pulse is generated by the tool changing device, which imparts an ejection force to the chisel because of the mass inertia of the chisel. The pulse can be built up, for example, by a vibration generated in the milling roller. It is also conceivable to provide one or several vibration devices. A further possibility lies in that a pulse generator is employed on the milling roller. To this end it is possible, for example, to assign a stop to the milling roller, which is provided with a contact face pointing in the work movement direction, and that a pulse generator creates a

force on the contact face which is directed opposite the work movement direction. The pulse generator here can be a mallet, which acts with its weight on this contact face.

As had already been explained above, the conception of the tool changing device can be such that the chisel is positioned in relation to the tool changer (see b) and c), above). Positioning of the chisel can take place, for example, by means of a displacement device, which positions the milling roller in relation to the tool changer. In accordance with a possible invention variation, this can take place in such a way that the milling roller is coupled with a drive motor of the construction machine by means of a drive train, wherein the displacement device has an auxiliary drive which can be coupled with the drive train and which turns the milling roller in the raised position by a predetermined or selectable angle of rotation, wherein the torque of the auxiliary drive is greater than the inertia of the milling roller and of the portion of the drive train moving together with the milling roller when the drive motor is switched off or uncoupled. In the course of this it is possible to utilize the preset position pattern of the chisels and to store it in a control device. In this case it can also be provided that the actuating unit and/or the displacement device have a position measuring system, and that the actuating unit and/or the displacement device are equipped with a numerical control.

In this case the layout of the tool can be such that the actuating unit positions the at least one tool changer in relation to the milling roller. In the course of this the tool changer and the milling roller are brought into positions in respect to each other.

It is also conceivable for tool changers to be arranged fixed in place on the machine. The chisels are then assigned to them by means of a rotation of the milling roller.

The tool changer can be laid out in such a way that it engages the chisel in a positive or non-positive manner and removes it from the chisel holder or installs it therein.

The tool change can be further automated if it is provided that the tool changing device conveys the removed chisels directly, or via a conveying device, to a container, or that a separating device is assigned to the tool changing device, and that the separating device conveys chisels from a storage unit to the tool changing device.

It is possible to achieve an optimal utilization of the tool down time if it is provided that a detection device is assigned to the milling roller, which checks the wear state of the chisels, or of a portion of the chisels, or of a single chisel, continuously, at intervals, or when directed, and that the detection device initiates or signals a tool change upon reaching a predetermined wear state.

For example, the wear detection can be designed in such a way that at least one signal reception unit of the detection device is assigned to at least one structural unit of the machine which directly or indirectly participates in the working process, that the signal reception unit detects an operational state of the structural unit of the machine, and that the signal reception unit determines the wear state via a signal processing arrangement.

The invention will be represented in what follows by means of the drawings. Shown are in:

Fig. 1, in a lateral view and partial representation a milling roller of a road-milling machine with a chisel holder

mounted thereon and with a tool changing device,

Fig. 2, the milling roller in accordance with Fig. 1 with a tool changing device for installing unworn chisels,

Fig. 3, a milling roller with a chisel holder formed on it in one piece in a lateral view and in section,

Fig. 4, a milling roller with a tool changing device in the milling roller interior in a lateral view, and

Fig. 5, the representation in accordance with Fig. 4 in a changed work position.

A rotary body of a road-milling machine, namely a milling roller 10, is represented in Fig. 1. Base elements 20 are arranged in a systematic separation from each other on the roller surface 11 of the milling roller 10. The base elements 20 are connected, preferably welded, to the roller surface 11. The base elements 20 have a plug-in receiver 21. A plug-in shoulder of a chisel holder 23 can be inserted into the plug-in receiver 21. Fixation in place of the chisel holder 23 on the base element 20 takes place by means of a pressure screw 22. The chisel holder 23 has a chisel receiver 24, which is embodied as a bore in the present case. A chisel 30, here a round shaft chisel, can be inserted into the bore. The chisel 30 has a chisel head 31, to the front of which a chisel tip 32, consisting of a hard alloy or a ceramic material, is fastened. A shaft 33, on which a clamping sleeve 34 has been drawn, adjoins the chisel head 31. The clamping sleeve 34 is connected with the shaft 33 so that it is not axially displaceable, but rotatable in the circumferential direction.

The chisel head 31 rests on a counter-surface of the chisel holder 23, with a wear-protection disk 35 placed between them.

As can be seen in Fig. 1, a tool changing device with a tool changer 40 is assigned to the chisel holder 23. The tool changer 40 has an actuating motor 43 driving a transfer member 41. In the instant case the transfer member 41 is designed as a draw bar. On the end facing away from the actuating motor 43, the transfer member 41 has an ejection mandrel 42. The ejection mandrel 42 can be introduced into the chisel receiver 24 by the actuating motor 43. Here, the mandrel penetrates the chisel receiver 24 through the rear bore opening 25. It then encounters the rear impact face constituted by the shaft 33. The actuating motor 43 pulls the ejection mandrel 42 into the chisel receiver 24. In the process the chisel 30, together with its clamping sleeve 34, is pushed out of the chisel receiver 24. After the chisel 30 has been moved out of the chisel receiver 24, the actuating motor 43 pushes the ejection mandrel 42 out of the chisel receiver 24 again.

The tool changer 40 can be displaced, for example linearly, in the direction of the center longitudinal axis of the milling roller 10 by means of an actuating unit not represented in the drawings. It then can be assigned to the individual chisel holders 23 of the milling roller 10 one after the other. Advantageously the actuating motor 43 does not only move one ejection mandrel 42, but several ejection mandrels 42 simultaneously, so that several chisels 30 can be pushed out of their chisel holders 23 in one actuating process.

It is also conceivable that the milling roller 10 could be rotated by means of an auxiliary drive mechanism of a displacement device. The auxiliary drive mechanism can be operated when the milling roller 10 has been lifted off the

ground. It can then be displaced for a tool change by means of the auxiliary drive mechanism. A control unit is also advantageously assigned to the auxiliary drive mechanism. It rotates the milling roller 10 in accordance with a preset program run, so that the chisels 30, or a portion of the chisels 30, can be oriented in respect to the tool changer 40.

A tool changer 40, which is used for installing an unworn chisel 30 into the chisel receiver 24, is represented in Fig. 2. Again, the tool changer 40 has an actuating motor 43, which linearly displaces the transfer member 41. The transfer member 41 has an assembly bell 44. The latter is provided with a receiver 45, in which the chisel head 31 of the chisel 30 to be installed is maintained. Accordingly, the tool changer 40 is assigned to the chisel holder 23 by means of an actuating unit. In this case the chisel shaft is located opposite the bore entry into the chisel receiver 24. Thereafter the actuating motor 43 is activated. The shaft 33 is then pushed into the chisel receiver 24. The threading movement of the shaft 33 into the chisel receiver is made easier by a conical bore widening 26. After the chisel 30 has been installed in the chisel holder 23, the chisel head 31 is released from the assembly bell 44. The actuating motor 43 again moves into its initial position and is then available for the next installation process.

The tool changers represented in Figs. 1 and 2 can be used individually or together in a road-milling device. If they are used together, a fully automatic chisel change can be performed.

A portion of a milling roller 10 is represented in Fig. 3. The milling roller 10 has a milling roller tube, which

constitutes the roller surface 11. Chisel receivers 24 have been directly cut into the milling roller tube, so that the chisel receivers 24 are connected in one piece with the milling roller tube. The chisel receiver 24 is constituted by a bore. The latter is provided on its bore end with a bore widening 26, which makes the insertion of the chisel 30 easier. A tool changer 40 is arranged at the other end of the bore. It can be embodied as a hydraulic or pneumatic cylinder and have a linearly displaceable ejection mandrel 42. It is of course also possible to employ the tool changing device represented in Fig. 3 in any arbitrary, different chisel holder system, in particular in a changer holder system as represented in Figs. 1 and 2. A chisel 30 has been inserted into the chisel receiver 24. In its structural type, it corresponds to the chisels 30 represented in Figs. 1 and 2.

The tool changer 40 is activated for removing the chisel 30 from its chisel receiver 24. The ejection mandrel 42 then moves against the free end of the chisel shaft 33. The ejection mandrel 42 ejects the chisel 30 in the direction of the center longitudinal axis of the chisel receiver 24. The tool changer can also be used to again install a fresh unworn chisel 30 into the chisel receiver 24. To this end, the chisel 30 would be connected with the extended ejection mandrel 42 and would be pulled into the chisel receiver 24 with the aid of the changing tool 40.

A further embodiment variation of a milling roller 10 with a tool changing device is described in Figs. 4 and 5. The tool changing device has a tool changer 40 housed in the interior of the milling roller 10. The milling roller 10 is constructed similar to the one in Fig. 3. It has chisel

holders 23 formed on it in one piece. It is of course also possible to employ any arbitrarily differently designed chisel holder 23 here.

The tool changer 40 has two articulated arms 47, 49, which are connected with each other by means of a hinge 48. The articulated arm 47 is fixed in place via a hinge 46. A pulse generator 50 in the form of a weight is arranged at the free end of the second articulated arm 49. On its interior circumference, the milling roller 10 has a stop 51 with a contact face 52. On the side facing away from the contact face 52, the stop 51 has an inclined deflection face 53.

During normal milling operations, the tool changer 40 is maintained in the position represented in Fig.5. If a chisel change is due, it is moved into the position shown in Fig. 4. Then the milling roller 10 is rotated in the circumferential direction until the pulse generator 50 impacts on the inclined deflection face 53 of the stop 51. A pulse is generated by this, which acts opposite to the removal direction of the chisels 30. Because of this pulse a force is introduced into the chisels 30 which pushes them out of the chisel receivers 24.

After the pulse generator 50 has impacted the contact face 52, it is deflected at the stop 51 and is again brought into its extended initial position via the inclined deflection face 53. If needed, the process for generating a pulse can then be repeated. At the termination of the ejection process the tool changer 40 is again returned into the position represented in Fig. 5. A reversal of the action principle is of course also possible. In that case the pulse generator can be rotated.